

SITING A POND

BY TIM MATSON

TEST PITS AND
SOIL SAMPLES ARE
THE KEY TO
KNOWING
WHETHER YOUR
CHOSEN POND
SITE WILL HOLD
WATER



There are two basic types of earth ponds: dammed and dugout. Choosing between the two is the easiest part of pond making because the site dictates the form.

On flat terrain where the water table is close to the surface, a dugout pond works best. A small dugout can be excavated in a day or two. The water source may be runoff, ground springs, stream diversion, piped well water, or even roof catch.

In hill country, a dammed pond is the most efficient to build. Earth excavated from the site simultaneously hollows out the pond basin and provides fill to build the dam. The ideal site for a dammed pond is a wet hollow lying between two steep banks close together. Such sites are often found at the headwaters of small springs, streams, or watercourses that are dry for part of the year.

Soil Tests

Examining the soil at the site is the first step in making a good pond. Several times I've stood gazing into a dry crater with a pond maker who neglected to test the soil. It's a sorry sight, and a reminder that in excessively porous soils, an earth pond will not hold water. All earth ponds seep naturally, but the right type of soil keeps it to a minimum.

Ideally, you should test the soil in late summer or fall, before the rain and snow season. If you test in the spring, you may overestimate runoff and impermeability. Begin by probing potential sites with a soil auger (see Figure 1). This hand-operated steel tool gets into the earth to test for rock, ledge, and soil quality. Borrow or rent an auger if you don't want to buy one. Make several soil borings in each pond

site you're considering. If you consistently hit rock at a uniform level, it's probably ledge. Ledge or bedrock may lie deep enough to permit the excavation of a pond, but fissures in the rock will drain water, especially down vertical grain. You can tap the vigorous springs that often surface in ledgy areas by siting the pond downhill from the ledge rather than right on top of it.

If the auger bores between 4 and 8 feet without striking rock, you may have a good pond site. To determine soil quality, pull the auger from the earth and examine the material extracted by the tip. Coarse-textured sands and sand-gravel blends are extremely porous and will not hold water. Watertight clay, silty clay, and sandy clay soils, on the other hand, make excellent pond materials. Test the soil by compressing a handful into a ball. A good clay or silty clay will hold together in a moist lump of fine-textured earth.

You can also measure the proportion of sand, silt, and clay in a sample of earth (see Figure 2). Filter a soil sample into a large glass jar through $\frac{1}{2}$ -inch screen to remove pebbles and gravel. Fill the jar $\frac{1}{3}$ full

with soil, top it off with water, and cap it. Then shake it up and set it aside for 24 hours. The coarse sandy material will settle first, then the silt, and finally the clay. The best pond material consists of particles ranging from small gravel or coarse sand to fine sand and clay. However, when you measure the proportions of the different soils, the top stratum of clay should comprise at least 20% of the total volume.

Test Pits

If there's no ledge and the soil sample is favorable, the next step is to dig test pits. In fact, many pond makers go directly to the test pit phase, using the backhoe as a back-saving auger. Shop around for a skillful backhoe operator, preferably one with pond-making experience. A backhoe is the pond maker's bionic arm. In an hour or so, you can unearth just about all there is to know about a pond, short of actually digging it. If the site fails the pit tests, it's simple to refill the holes. But if you skip the testing, you may wind up refilling the whole pond. To save time and money, dig during the dry season so the backhoe doesn't get stuck in the mud.

Be sure there are no obstructions for the backhoe — no transmission wires over the pond site to snare the arm or bucket, and no electric lines or pipes underground. On brushy or wooded sites, be sure to clear ground around each test pit so the machine can heap soil on the downstream side of each digging. Otherwise, rain will wash earth back into the pit.

Before you begin to dig, stake out the approximate pond shoreline. On a level dugout pond site, it's simple to mark an imaginary shoreline. On sloping terrain suited to a dammed pond, it helps to visualize the shoreline by standing at the lowest edge of the pond area — the location of the dam — so that your eyes are in plane with the desired water level. A hand-sighting level or transit helps in this process. In a pinch, use a poor-man's transit: Set up a carpenter's level on a stepladder, leveled at the



Figure 1. Use a hand auger for preliminary soil tests. There are two types: a pigtail auger, which has a spiral bit like a ship's auger, and a bucket auger, shown here. Both types are available with threaded extensions for probing deep below the surface.

Simple Soil Test

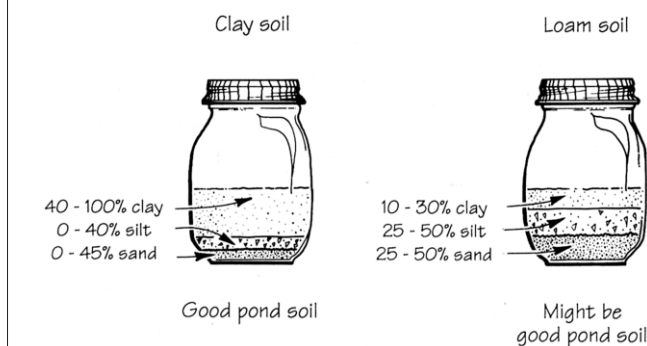


Figure 2. To measure the proportion of sand, silt, and clay in a soil sample, place the sample in a glass jar, top it off with water, and cap it. Then shake it and let it settle for 24 hours. For good pond soil, the top stratum of clay should comprise at least 20% of the total volume of soil in the jar.

shoreline height. Sight down the edge and swing the level around, following the water line. Remember that you want a minimum of 5 to 6 feet of water in the pond.

Excavate test holes at random from the center of the planned pond basin to the shoreline. If the soil is uniform, three or four pits may be sufficient. If the terrain varies, dig more test pits. For dammed ponds, don't forget to dig where the dam will be constructed. If the auger or backhoe hits shallow ledge, reposition the dam or move the pond. Dams on ledge tend to leak.

As the backhoe digs, note the different layers of earth — the soil "profile." Separate the top 6 to 8 inches of topsoil from the rest of the material so you can use it later to nourish your shoreland. If you hit deep, heavy subsoil thick with clay, you have pond maker's gold. But beware of limestone and sandstone, since both are too permeable to hold water.

Watch for water while the backhoe cuts into the ground. A strong vein of water will quickly break through the punctured earth and bleed into the test pit. For dugout ponds, the higher the water level the better, especially during the summer months, when ground water can dissipate quickly. A test pit that comes up dry, or that exposes a deep vein of water barreling through sand, is not a good sign. However, a test pit that fills to near ground level in dry weather is virtually a miniature dugout pond. Its water level should be roughly the same as that of the finished pond.

At this point, it helps to refine the pond's shoreline. Using the test pits as guides, restake the pond to exclude ledge or unsuitably porous soils, and maximize space where water is abundant. On a sloping site where a dammed pond is planned, be sure to reserve a space

about 30 to 50 feet wide on the downstream shoreline for dam construction.

Storage Capacity

Once you've determined the suitability of the soil at the planned pond site, you can mesh the pond's size with the watershed. The storage capacity of a pond is usually counted in acre-feet (see "Watershed Reckoning"). I've had success overloading a pond with ten times more runoff than was called for. Overloading helps keep the pond fresh and full, but it won't work without tight watershed soils, a sturdy spillway, and, in the case of dammed ponds, a hefty embankment. By far the worst mismatch occurs when the watershed falls short of supplying a pond. It's worth a few hours of mapping and math to make sure the pond site won't leave you dry. ■

Tim Matson is a pond consultant and writer in Thetford Center, Vt.

For More Information

Ponds: Planning, Design, Construction (Handbook No. 590) is available from the USDA Soil Conservation Service, USGPO, Washington, D.C. 20402.

An index of topographical maps and prices is available from Earth Science Information Center, Reston, VA; 800/872-6277.

Tim Matson's book, *Earth Ponds*, is available from Countryman Press, P.O. Box 175, Woodstock, VT 05091; 802/457-1049 (\$19.45 postpaid). A video on pond making by Matson is available from Earth Ponds Company, RR1, Box 77, Thetford Center, VT 05075; 802/333-9019 (\$32.95 postpaid).

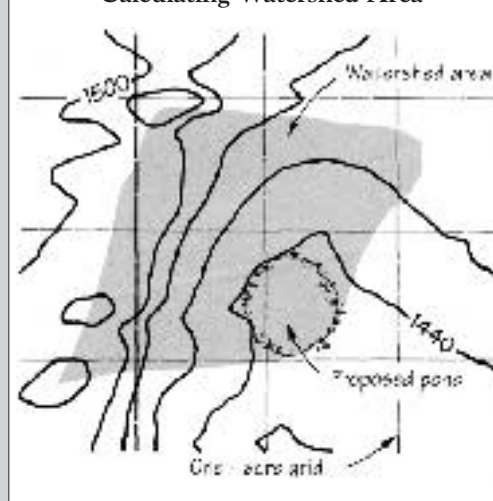
Watershed Reckoning

The watershed is the total land area that will eventually drain into your pond. Every square foot of land that funnels precipitation and ground water to the pond site affects the volume and water quality of the reservoir. When you know the watershed acreage, you can calculate pond capacity.

To figure your watershed, use Soil Conservation Service maps and photographs, or a U.S. Geological Survey topographical index map (see "For More Information," at the end of this article). Trace the contours of the area that drains into the site (see illustration). Using the map's scale, draw a grid over the watershed area so that each square in the grid equals one acre (approximately 208 feet square). Count the number of squares (estimate the area of partial squares) to get the total acreage of the watershed.

The topography of the site and its setting usually suggest how large and

Calculating Watershed Area



To determine watershed area for a pond, trace the contours of the area that drains into the pond site on a topographical map. Using the map's scale, superimpose a grid of one-acre squares, then count the number of squares in the watershed area to calculate its total acreage. The watershed area in the illustration has about 3 1/4 acres.

what shape the pond should be. When you know the total number of acres that shed water into your pond site, you can match the storage capacity of the pond to the water supply.

The storage capacity of a pond is usually counted in acre-feet. To calculate acre-footage, first determine the surface area of the pond. For a nearly round pond, like the one in the illustration, this is a matter of simple geometry: $\text{Area} = \pi r^2$. For an irregularly shaped pond, plot the shoreline to a convenient scale on graph paper and figure the area as you did for determining watershed area, counting the squares (1 acre = 43,560 square feet).

Next, estimate the depth. The acre-footage formula averages the depth of all ponds at a uniform 40% of maximum, so multiply the maximum water depth by 0.4. Take the result and multiply it by the surface acreage to get acre-footage.

For example, the calculation for the pond in the example, which has a surface area of 17,670 feet and a maximum depth of 10 feet, looks like this:

Pond Surface Area

17,671 sq.ft. ÷ 43,560 sq.ft. per acre = .41 acres

Average Pond Depth

10 ft. max. depth x .4 (40% of max.) = 4 ft.

Pond Capacity

4 ft. x .41 acres = 1.64 acre-ft.

The final step is to adjust the size of the pond to its watershed. In prime pond-making country east of the Mississippi and in the Northwest, this rough rule of thumb determines the ratio of watershed acreage to pond capacity: Each acre-foot of pond should receive runoff from territory no larger than 2 acres, if the ground cover is all woods or brush. If the ground cover is pasture, the drainage area should not exceed 1 1/2 acres for each acre of pond. On cultivated land, each acre-foot should receive runoff from no more than 1 acre. If the watershed is mixed, calculate accordingly. The pond in the illustration, which is located in a wooded area, can hold all of the water that drains from about 3 1/4 acres (1.64 acre-feet x 2) and so is well-matched to its watershed area.

— T. M.